Figure 5.28 Proposed rerouted eastbound cycleway

Public transport opportunities

At the Parramatta Road interchange, the project allows for future provision of a seven metre-wide, central-running mass transit corridor on Parramatta Road.

As described in **Chapter 3** (Strategic context and project need), Transport for NSW has begun planning for improved transport in the Parramatta Road corridor under its Parramatta Road Corridor Transport Improvement Program. The program includes a series of projects to promote an integrated multimodal transport system and realise urban renewal in the corridor.

Options for improving public transport along Parramatta Road are at a preliminary stage. More detailed work would be undertaken by Roads and Maritime and Transport for NSW to investigate public transport improvements and intersection treatments that could be delivered on Parramatta Road after the opening of the project. These potential public transport improvements do not form part of this project and would be subject to separate planning processes and approvals as appropriate.

5.10 Utility services

The project would require connection to mains power and water supply for the safe and efficient operation of the tunnels.

5.10.1 Electricity

Electricity supply infrastructure would be installed to supply power to the mainline tunnels and associated mechanical and electrical equipment. It is essential that electrical power to the tunnels be uninterrupted for ventilation, lighting and other safety reasons.

The electricity supply system would consist of two independent 33 kilovolt feeders supplied from the Ausgrid Homebush substation to the north of the Homebush Bay Drive interchange. The feeders would connect to a project supply substation on the eastern side of Ismay Avenue, just north of the existing M4, where the power supply would be stepped down to 22 kilovolt. From the project supply substation, power would be reticulated to another eight substations along the project.

Of the nine proposed substations, three would be located underground in breakdown bays within the mainline tunnels, and six would be located above ground. The locations of substations are shown on **Figure 5.2** to **Figure 5.8**. The above ground substations would be located at:

- Underwood Road – a substation would be contained within the ventilation building at this site and would sit completely within the cut-and-cover tunnel cavity
- Ismay Avenue – the main supply substation building would be located above the westbound tunnel with an adjacent fire pump room
- Concord Road interchange – a substation building would be located above the cut-and-cover tunnel on the north-eastern corner of the Concord Lane and Sydney Street intersection
- Cintra Park – a substation building would be located adjacent to the fresh air supply facility, incident management centre and the water treatment plant
- Parramatta Road substations – two separate stand-alone substation buildings would be located adjacent to the Parramatta Road ventilation facility, one for the project and one for the possible future M4–M5 Link

The M4–M5 Link substation at the eastern ventilation facility would comprise a building only, and fitout would occur as part of construction of the M4–M5 Link (if approved).

The electricity supply system to the motorway operations complex would be sourced from the high voltage tunnel power system. The anticipated energy consumption of each operational component is summarised in **Table 5.5**.

Table 5.5 Anticipated operational power requirements

Location	Power requirement (megawatt hours a year)
Western ventilation facility	10,700
Eastern ventilation Facility	4,325
Tunnel lighting, pumps and ventilation	5,600
Street lighting, ITS and other control systems	840
Water treatment plant and drainage pumps	1,025
Substation cooling	3,000
Motorway operations complex at Homebush Bay Drive	2,650

If electricity supply is not available, a system of uninterrupted power supplies would provide back-up power for operation of essential equipment for at least 60 minutes. Essential operational equipment would include:

- Communications and monitoring equipment
- Computer systems
- Fire and life safety systems
- Tolling systems
- Tunnel signage
- Emergency power outlets
- Closed circuit television
- Emergency lighting, which would be distributed evenly along the tunnels.

5.10.2 Water

Mains water would be required during tunnel operation for:

- Tunnel deluge system (testing and operation)
- Tunnel wall washing
- Motorway operations complex ablutions
- Landscape irrigation at the interchanges (for establishment post construction).

The anticipated volume, source, management and treatment of operational water are detailed in **Table 5.6**.

Table 5.6 Anticipated source and volume of operational water

Activity	Estimated requirement	Source	Management	Treatment
Tunnel deluge system (fire suppression)	350 litres per second during emergencies only	On site tanks fed from mains water	Stormwater drainage system	First flush segregation only
Testing of tunnel deluge system	Up to 40 kilolitres a year	On site tanks fed from mains water	Stormwater drainage system	First flush segregation only
Tunnel wall washing	2.16 megalitres a year	Mobile water tankers filled from mains water supply	Groundwater drainage system	Operational water treatment facility at Cintra Park
Motorway operations complex ablutions	150 kilolitres a year	Mains water	Sewerage system	None

The primary water source for the tunnel deluge system would be water tanks and fire pump facilities at the following locations:

- Above the westbound tunnel to the east of Ismay Avenue
- At the Parramatta Road ventilation facility.

The tunnel deluge and fire suppression system, including number, location and capacity of water storage facilities, would be designed and sized to meet the requirements of Fire & Rescue NSW.

5.11 Property access and acquisition

The project has been designed to minimise land acquisition and limit the severance of private properties.

The project would involve acquisition of around 182 properties (comprising private property, and land owned by councils, public authorities or the State of NSW), in addition to the 98 properties already owned by Roads and Maritime. In addition, it is anticipated that four properties would be leased during construction. One of these properties would be returned to its owner in its entirety following construction, while the other three properties to be leased would also be affected by permanent partial acquisition.

Of the 182 properties to be acquired, 43 properties would be required only during construction and would not contain any operational project components. Following construction, where feasible, residual land not required for operational project components would be made available for redevelopment. The future use of this residual land would be subject to separate assessment and planning approval.

In addition to the 291 properties affected by surface works, there would be subsurface acquisition of land below 697 properties. There would also be subsurface acquisition of some residual land that would otherwise be acquired for the project.

A full list of properties currently proposed to be acquired or leased is provided in **Appendix D**. **Figure 5.29** to **Figure 5.33** show the location of property to be acquired and land already owned by Roads and Maritime.

The project would require the acquisition of four properties which are under the ownership of the State of NSW and therefore are considered to be Crown land. One property would be fully acquired as part of the project, while three properties would be partially acquired. Two of the three properties to be partially acquired would also be leased during construction. Impacts on Crown land are discussed further in **Chapter 12** (Property and land use).

Where partial acquisitions are required, associated property adjustment, such as realignment of private property fencing, would be undertaken.

The total area and number of properties that would be acquired and leased for the project may change as the project is refined during detailed design, or in response to changes resulting from the exhibition of this EIS and conditions of approval that may be applied by the Minister for Planning.

Final partial and full property acquisitions would be confirmed through detailed design and undertaken in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2012b) and the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW). Consultation with affected property owners has commenced and is discussed in **Chapter 12** (Property and land use). Consultation would continue throughout detailed design.

Access to all properties not affected by acquisition or temporary lease would be maintained throughout construction and operation of the project. Where impacts to access are unavoidable, consultation with the affected landowner would occur to determine their access requirements and to determine potential alternate arrangements. Alterations to local roads would result in some changes to access arrangements for a number of properties.

Further details of property acquisitions, alterations to property access and future use of residual land are provided in **Chapter 12** (Property and land use).

Figure 5.29 Property acquisition and residual land - Map 1

Figure 5.30 Property acquisition and residual land - Map 2

Figure 5.31 Property acquisition and residual land - Map 3

Figure 5.32 Property acquisition and residual land - Map 4

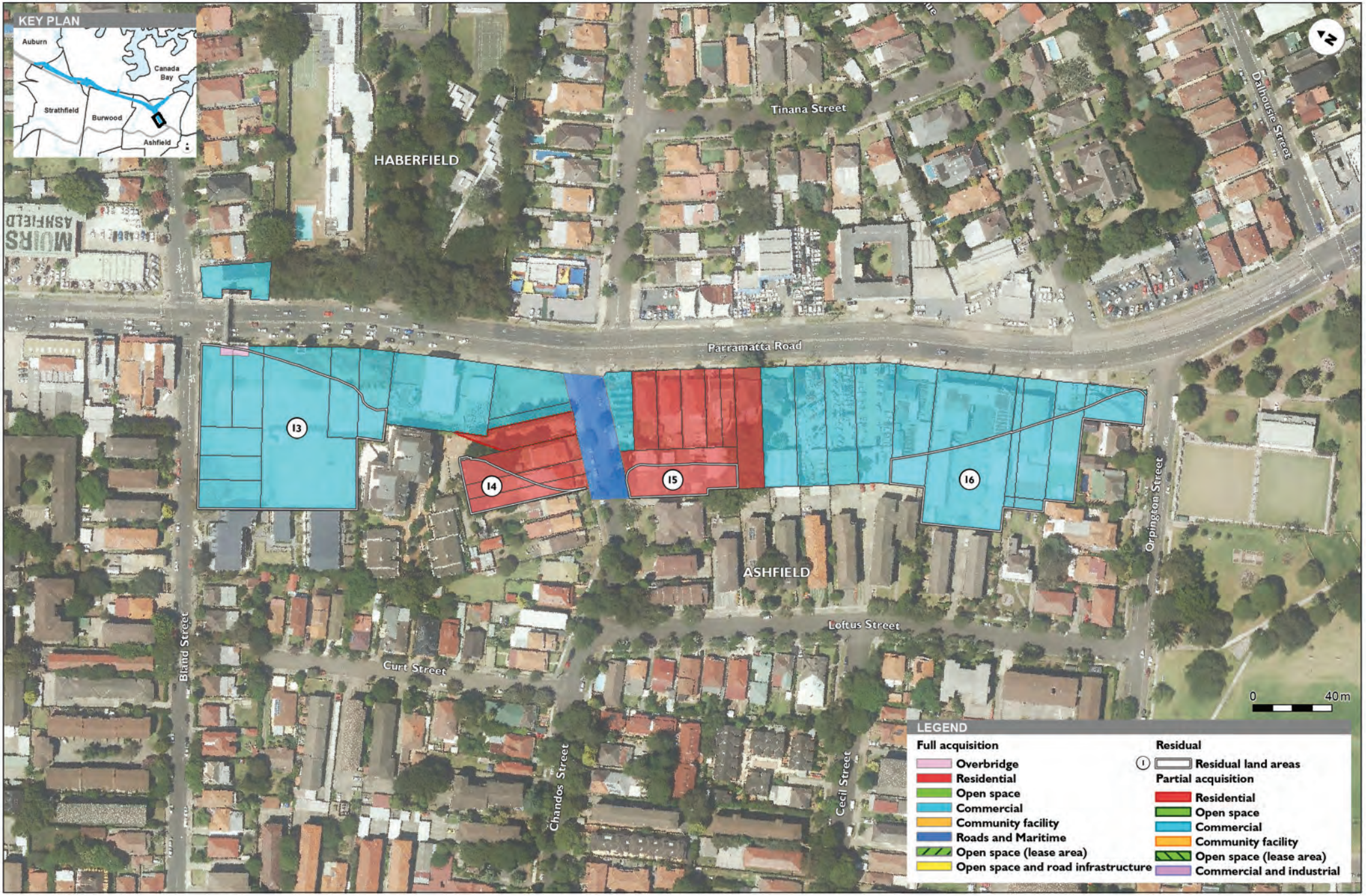

Figure 5.33 Property acquisition and residual land - Map 5

6 Construction work

This chapter describes the proposed approach to construction of the M4 East project (the project). It outlines the construction program and footprint, construction methods, temporary construction ancillary facilities, traffic management, construction working hours, materials and equipment, and spoil management based on the concept design.

The Secretary of the NSW Department of Planning and Environment has issued a set of environmental assessment requirements for the project; these are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 6.1** sets out these requirements, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 6.1 SEARs for the M4 East project – project description

Secretary's Environmental Assessment Requirements	Where addressed in EIS
A detailed description of the project including:	
Location and operational requirements of construction ancillary facilities and access tracks.	**Section 6.5** (construction ancillary facilities) and **section 6.6.1** (access tracks and diversions)

The description of the construction work provided in this chapter is based on methodologies developed to construct the concept design (as described in **Chapter 5** (Project description)). The construction methodology will be refined during detailed design, guided by the key principles developed during the concept design and EIS phase. Sufficient flexibility has been provided in the construction methodology to allow for refinement during detailed design and in response to any submissions received following the exhibition of this EIS or to minimise environmental impacts.

The detailed construction methodology would:

- Be consistent with key principles as described in this EIS and any subsequent response to submissions or preferred infrastructure report
- Address any unresolved issues associated with the development of the concept design proposed in this EIS and any subsequent response to submissions or preferred infrastructure report
- Meet any conditions of approval arising from the approval process under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW)
- Further develop and refine mitigation measures
- Address:
  - Constructability
  - Traffic capacity and safety during construction
  - Geotechnical issues
  - Relevant NSW Roads and Maritime Services (Roads and Maritime) specifications and design requirements, current guidelines and policies
  - Practicality/cost effectiveness
  - Risk management.

Detailed construction planning and methodologies would be finalised before construction starts, and would be documented in a Construction Environmental Management Plan (CEMP).

The project would result in a road classified as a freeway or tollway under the *Roads Act 1993* (NSW) and containing four or more traffic lanes over a distance of more than one kilometre in the Sydney metropolitan area. In accordance with clause 35 of Schedule 2 of the *Protection of the Environment Operations Act 1997* (NSW), an environment protection licence would be required for construction of the project.

6.1 Construction strategy

The construction strategy for the project would ensure that construction occurs in a safe and efficient manner while at the same time managing identified constraints and mitigating environmental impacts. Detailed construction planning would occur before construction starts. General principles of the construction strategy are as follows:

- Minimise the length of the construction period
- Make construction staging and sequencing as safe and efficient as possible, providing a simplified construction process where practical
- Minimise traffic stages and mitigate traffic impacts on road users
- Where possible, locate temporary construction facilities on sites where permanent works are proposed
- Design and plan efficient site layouts which ensure the safety of project staff and the public and include traffic management arrangements that require heavy vehicle construction traffic to use main and arterial roads where possible and minimise use of local roads
- Minimise interdependencies between the construction disciplines of tunnelling, surface works, and mechanical and electrical fitout and commissioning.

The construction strategy recognises that project delivery time is significantly influenced by the complexity and magnitude of the interfaces between tunnelling activities and the construction of the surface civil structures. Developing and maintaining a coordinated project, but separating delivery of the civil surface works and tunnel activities as far as practical, reduces the overall duration of construction and minimises risk to delivery timing.

This will be achieved by:

- Creating specific access sites for tunnel activities, rather than relying on portal access
- Separating works into independent packages (as far as possible) that can be undertaken concurrently across the project alignment, thereby minimising the overall construction timeframe.

Independence between surface civil works and tunnelling activities delivers:

- Efficiency in both tunnelling activities and surface works
- Reduced management effort to deliver the works
- Fewer levels of staging and less complexity for each discipline
- Reduced work activity interface and the resulting safety risk
- Minimal risk of one activity impacting the other, thus reducing the overall project delivery timeline and risk.

6.2 Construction program

Subject to planning approval, construction of the project is planned to start in the second quarter of 2016, with completion planned for the first quarter of 2019. The total period of construction works is expected to be around three years, with around nine months of commissioning occurring concurrently with the final stages of construction. The indicative construction program is shown in **Table 6.2.**

Table 6.2 Indicative construction program overview

Construction activity	Indicative construction timeframe															
	2016				2017				2018				2019			
Shaft and decline excavations (all sites)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tunnelling (excavation)			■	■	■	■	■	■			■	■				
Tunnel drainage and pavement works						■	■	■	■	■						
Tunnel mechanical and electrical fitout								■	■	■	■					
Tunnel completion works											■	■	■			
Homebush Bay Drive ramps			■	■	■	■	■	■	■	■						
M4 surface works		■	■	■	■	■	■	■	■	■	■	■				
Western ventilation facility							■	■	■	■	■					
Powells Creek on-ramp		■	■	■	■	■										
Concord Road interchange			■	■	■	■	■	■	■	■	■	■				
Wattle Street interchange		■	■	■	■	■	■	■	■	■	■	■	■			
Parramatta Road interchange		■	■	■	■	■	■	■	■	■	■	■	■			
Eastern ventilation facility		■	■	■	■	■	■	■	■	■	■	■				
Cintra Park fresh air supply facility				■	■	■	■	■	■	■	■	■	■			
Cintra Park water treatment facility										■	■	■				
Motorway operations complex						■	■	■								
Mechanical and electrical fitout works							■	■	■	■	■	■				
Site rehabilitation and landscaping						■	■	■	■	■	■	■	■			

6.3 Construction footprint

The total area required for construction of the project, including construction ancillary facilities, is referred to as the 'construction footprint'. The construction footprint would be about 65 hectares, comprising about 48 hectares at the surface and about 17 hectares below ground. An overview of the construction footprint is shown in **Figure 6.1**, with greater detail provided in **Figure 6.2** to **Figure 6.8**.

This is anticipated to require the clearing of about 13 hectares of planted trees and screening vegetation (the majority along the existing M4) and about three hectares of grassland with scattered trees. Scattered trees located within private gardens would also be removed. Further information is provided in **Chapter 20** (Biodiversity).

In addition to below ground works, surface works would be required to support tunnelling activities and to construct surface infrastructure such as interchanges, tunnel portals, ventilation facilities, the fresh air supply facility, ancillary operations buildings and facilities, the re-routed eastbound cycleway near the Homebush Bay Drive interchange, and the new westbound cycleway on-ramp near Queen Street at North Strathfield.

The overall surface construction footprint generally aligns with the operational footprint (refer to **section 5.3** in **Chapter 5** (Project description)), with the locations of future operational ancillary facilities being used to support construction work. Some additional areas adjacent to the operational footprint (around the portals and on- and off-ramps, and also at the tunnel mid-point) would also be required during the construction stage only to facilitate construction.

Construction ancillary facilities would be located at the following 10 locations:

- Homebush Bay Drive civil site (C1)
- Pomeroy Street civil site (C2)
- Underwood Road civil and tunnel site (C3)
- Powells Creek civil site (C4)
- Concord Road civil and tunnel site (C5)
- Cintra Park tunnel site (C6)
- Northcote Street tunnel site (C7)
- Eastern ventilation facility site (C8)
- Wattle Street and Walker Avenue civil site (C9)
- Parramatta Road civil site (C10).

Refer to **section 6.5** for further details on construction ancillary facilities. The final size and configuration of construction ancillary facilities would be further developed during detailed design.

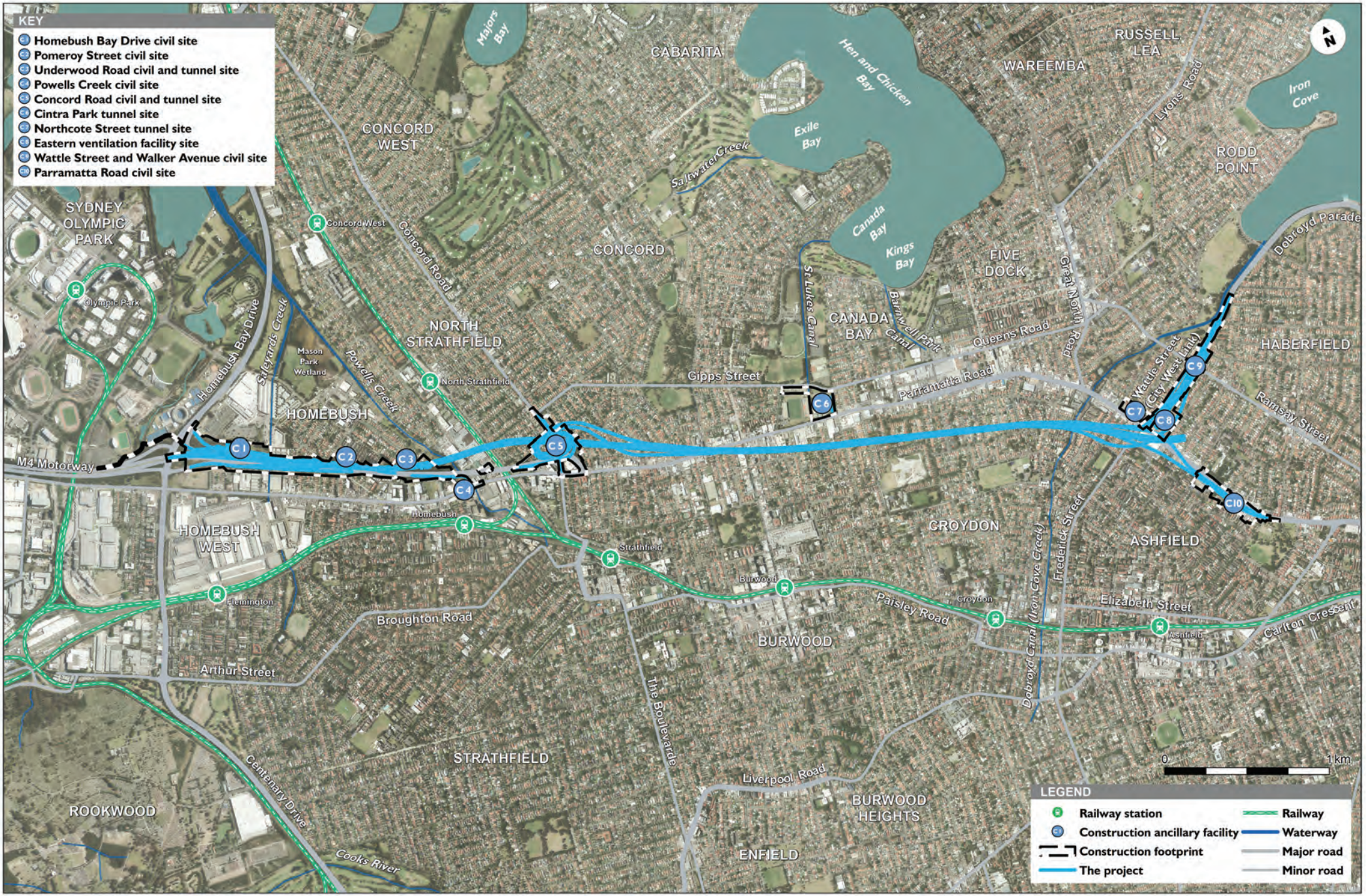

Figure 6.1 Overview of construction footprint and construction ancillary facilities

Figure 6.2 Project construction footprint - Map 1

Figure 6.3 Project construction footprint - Map 2

Figure 6.4 Project construction footprint - Map 3

Figure 6.5 Project construction footprint - Map 4

Figure 6.6 Project construction footprint - Map 5

Figure 6.7 Project construction footprint - Map 6

Figure 6.8 Project construction footprint - Map 7

6.4 Construction methodology

The construction methodology would include enabling works to facilitate the main construction activities, tunnelling activities, and surface civil, road and building works. These activities are summarised in **Table 6.3** and detailed in the following sections.

Table 6.3 Construction works overview

Component	Typical activities
Enabling works	• Property acquisition • Demolish existing buildings • Traffic management changes and measures • Install safety and environmental controls • Establish construction facilities and access • Supply utilities to construction facilities • Heritage salvage or conservation works (if required) • Minor clearing works
Tunnelling	• Construct declines and shafts • Excavation of mainline tunnels, ramps and associated tunnelled infrastructure • Spoil management • Finishing works in tunnel and provision of permanent tunnel services • Testing of plant and equipment
Surface earthworks and structures	• Vegetation clearance and topsoil stripping • Excavate new cut and fill areas • Construct dive and cut and cover tunnel structures • Construct required retaining structures • Excavate new road levels
Bridge works	• Construct piers and abutments • Construct headstock • Construct bridge deck, slab and girders
Drainage	• Construct new pits and pipes • Construct new groundwater drainage system • Connect drainage to existing network • Construct sump in eastbound tunnel • Construct water quality basins • Construct spill containment basin • Construct onsite detention tanks • Adjustments to existing drainage infrastructure where impacted
Pavement	• Lay base and select layers • Lay road pavement • Construct pavement drainage (eg kerb and gutter)
Operational ancillary facilities	• Ventilation systems and facilities • Fresh air supply facility • Water treatment facility • Motorway operations complex • Electrical substations • Fire pump rooms and water tanks • Test plant and equipment
Finishing works	• Line marking of new road surface • Erect directional signage and other roadside furniture such as street lighting • Erect toll gantries and other control systems • Landscaping works • Site demobilisation and rehabilitation of temporary construction ancillary facilities

6.4.1 Enabling works

Enabling works are works that would generally take place early in the construction program in order to facilitate the main construction activities. Enabling works for the project would include:

- Property acquisitions
- Demolition of buildings
- Traffic management changes to allow access to and egress from construction sites
- Installation of safety and environmental control measures
- Establishment of construction site fencing and hoardings
- Construction ancillary facility establishment, including access roads
- Provision of power and other services to the construction sites
- Heritage salvage, archival recording and conservation works
- Minor clearing works to facilitate other enabling works.

6.4.2 Tunnelling

Tunnel excavation

The project would involve the excavation of two mainline tunnels, each around 5.5 kilometres long, for the main alignment, as well as additional tunnels for on- and off-ramps at the Concord Road interchange, the Wattle Street interchange and the Parramatta Road interchange. The depth of the mainline tunnels below ground level would vary according to geological constraints. At the deepest point the tunnel crowns (top of the tunnels) would be about 50 metres below ground level, with shallower sections approaching the interchanges.

The mainline tunnels would be excavated using a heading and bench construction methodology. Excavation of the heading (top section of the tunnel) would be carried out using roadheaders, launched from the tunnelling sites. A roadheader is an excavation machine consisting of a boom-mounted rotating cutter head fitted on bulldozer-style tracks, a loader device (usually on a conveyor), and a crawler travelling track to move the machine forward into the rock face.

The bench (lower section) in the mainline tunnels would be excavated using drill and blast techniques, reducing the reliance on roadheaders. The drill and blast excavation method involves a sequence of the drilling of holes, charging the holes with explosive, blasting, mucking out and installing the roof and wall ground support. The drill and blast method offers the shortest potential exposure to vibration for residents and businesses above the tunnels.

Blast patterns would be designed and sequenced to minimise impacts of vibration on residents and businesses above the tunnels. Blasting would only be undertaken underground and only in locations where the geology is suitable for safe and effective use. It is not expected to be utilised in the shallower sections of tunnel construction, where variable ground conditions exist. On- and off-ramp tunnels would be constructed primarily using roadheaders.

Some pedestrian cross passages between the mainline tunnels would be sized to fit excavation machinery, to allow movement of plant in both directions. The majority of cross passages would be excavated by drill and blast techniques, but some may also be excavated by roadheader or rock breaking methods.

Ground support, including rock bolting and shotcrete, would be installed as the tunnelling face is advanced. Tunnel lining would also be installed progressively following tunnel excavation. The type of lining would depend on the local geology and groundwater inflows. As the project is primarily located within low permeability sandstone and likely to be predominantly dry, a sprayed shotcrete lining would generally be used. In areas with medium groundwater inflows, a sprayed waterproofing membrane would also be installed, with a shotcrete or cast in situ concrete secondary lining. Where there are significant groundwater inflows, grouting may also be used to reduce the permeability of the surrounding rock mass.

Tunnelling launch and support sites would be required, as outlined in **section 6.5**. Each tunnelling site would provide support services for the tunnelling activity including power supply, ventilation, water supply, construction water treatment plants, workforce facilities and spoil handling and removal areas and facilities. At the tunnel launch sites, construction access tunnels that connect to the mainline tunnels would be excavated with rock hammers.

In addition to the mainline tunnels and on- and off-ramps, the following tunnelled infrastructure would be constructed using either roadheaders, excavators with rock hammers, or drilling and blasting:

- Pedestrian cross passages
- Long egress passages and associated cross passages
- Ventilation shafts
- Tunnel sumps
- Underground electrical substations.

Tunnel civil finishing works

On completion of the tunnel excavation works, a variety of civil finishing works would occur, including:

- Installation of stormwater and groundwater drainage systems
- Application of waterproofing membrane (where required)
- Pavement construction
- Construction of:
  - Cross passages and long egress passages
  - Underground electrical substations
  - Low point sump
- Installation of:
  - Electrical and communication conduits
  - Deluge and hydrant fire mains
  - Road furniture (eg lighting, signage)
  - Architectural panels
- Painting.

Tunnel fit out and commissioning

Following tunnel excavation and civil finishing works, the tunnels would be fitted out with operational infrastructure including power, ventilation, fire safety systems, communications, traffic control, tunnel lighting and the operations management and control systems.

This would be followed by a comprehensive commissioning process to validate the operation and integration of tunnel systems before the road opens.

6.4.3 Surface earthworks and structures

Surface earthworks would be required for the following above ground locations:

- Construction ancillary facilities
- Re-routed cycleway on the northern side of the existing M4, starting west of the Homebush Bay Drive interchange to near Underwood Road
- Widening, realignment and resurfacing of the existing M4 east of the Homebush Bay Drive interchange

- New and modified ramps on the existing M4 at Homebush Bay Drive, Powells Creek and Concord Road
- New cycleway on-ramp to the existing M4 westbound near Queen Street at North Strathfield
- Dive structures and cut-and-cover tunnel sections for on- and off-ramps at the four interchange locations
- Realignment of Wattle Street and associated side roads
- Realignment of Parramatta Road and associated side roads
- Permanent ancillary facilities such as the motorway operations complex, ventilation facilities, above ground electrical substations, fire pumps and water tanks, water treatment facility and water quality basins.

Earthworks, including for dive structures, would be completed using conventional methods of road construction including:

- Vegetation clearance and topsoil stripping
- Areas of new cut and fill, and widening of existing cuts and embankments, including construction of retaining walls and reinforced soil walls to design levels
- Installation of road drainage infrastructure.

Construction of the cut-and-cover tunnel sections would generally involve:

- Ground preparation and construction of piling platforms
- Piling of the dive and cut-and-cover structures using bored pile techniques
- Construction of the capping beam on top of the piles
- Excavation of soil and rock using a variety of techniques (including dozers, excavators and rock breakers) depending on ground conditions and site constraints, and application of shotcrete to the excavated face
- Construction of the roof structure, likely to be precast concrete planks with a cast in-situ concrete deck, and bracing
- Installation of drainage and services.

6.4.4 Bridge works

The project would require seven new bridges to be constructed, and three existing bridges to be modified or replaced (as described in **section 5.8.1** of Chapter 5 (Project description). Construction of the new bridges would generally involve:

- Construction of the substructure (piers and abutments), likely to be from cast in situ concrete in the following sequence:
  - Piling works, such as driven or bored piles
  - Pile cap construction including localised excavation around the piles
  - Pier or column construction
- Construction of the headstock (pier cap which transfers loads from the superstructure to the piers)
- Construction of the superstructure (bridge deck, slab and girders), likely to be through the placement of precast concrete segments.

For the existing bridges to be modified or replaced, construction methodologies would be as described in **Table 6.4**.

Table 6.4 Indicative works for bridges to be modified or replaced

Location	Crossing type	Construction methodology
M4 near Homebush Bay Drive	Replacement of M4 bridge over Saleyards Creek	The existing bridge superstructure and the top of the abutment walls would be demolished, while the rest of the substructure would be left in place. Widening on both sides of the existing structure would require a portion of the abutment wall and wingwalls to be demolished and replaced with similar structures. The structure would consist of driven piles and precast planks with an in situ topping slab sitting on strip bearings. Where reasonable and practicable, work would be staged so that traffic lanes on the M4 could remain open during bridge replacement. This would require works to be undertaken outside standard construction hours (refer to **section 6.7.2**).
Concord Road interchange	Widening of Concord Road bridge, over the existing M4, and new eastbound on-ramp	The Concord Road bridge would be widened to accommodate an eastbound tunnel on-ramp to the M4 East from Concord Road northbound. A portion of the existing bridge would be demolished along the line of the existing traffic barrier on the western side, and a new concrete deck 'stitched' to the existing bridge. The eastbound on-ramp would be constructed using the methodology for new bridge construction. Services under the existing western footpath would be relocated to a support frame below the superstructure. Where reasonable and practicable, work would be staged so that traffic lanes on the M4 could remain open during bridge widening. This would require works to be undertaken outside standard construction hours (refer to **section 6.7.2**).
Bland Street	Modification of Bland Street pedestrian bridge	The existing stairs adjacent to Parramatta Road would be demolished. New stairs would be installed between the existing lift core and Bland Street. Where possible, pedestrian access across the bridge would be maintained at all times. Short shutdown periods may be required for safety reasons. Alternative pedestrian access would be available via the existing traffic signals.

6.4.5 Drainage

The project would require construction of new drainage infrastructure and alterations to existing drainage infrastructure. This would include:

- Construction of new pits and pipes for both surface and tunnel sections of the road
- Construction of a new groundwater drainage system
- Connection of new surface drainage infrastructure to the existing drainage network
- Construction of a low point sump in the eastbound tunnel, which would collect water from both the eastbound and westbound tunnels

- Construction of two new water quality basins – one on the western side of Saleyards Creek at the Homebush Bay Drive interchange and one at Cintra Park – to collect water during operation
- Construction of a spill containment basin on the eastern side of Saleyards Creek at the Homebush Bay Drive interchange
- Construction of a spill containment basin, gross pollutant trap, or similar management measure at the new Powells Creek on-ramp
- Construction of an onsite detention tank adjacent to Bland Street
- Construction of a water treatment facility at Cintra Park, to treat collected groundwater
- Demolition and reconstruction of pits and pipes, alterations to existing drainage systems around the four interchanges, and culvert reconnection (where required).

6.4.6 Pavement

Following tunnelling, surface earthworks, bridge works and drainage works, the road surface (pavement) would be established. This would involve the construction of:

- Base and select layers of materials (in areas of earthworks only)
- Road surface layers
- Pavement drainage, including kerb and gutter (where required)
- Concrete barriers, wire rope fencing and guardrails (where required).

6.4.7 Operational ancillary facilities

The project would involve the construction of a number of operational ancillary facilities including:

- Ventilation facilities and fresh air supply facility
- Motorway operations complex, comprising the motorway control centre and maintenance facility building
- Operational water treatment facility at Cintra Park
- Electrical substations (including incident response centre at Cintra Park)
- Water tanks and fire pump rooms.

The construction methodology for the operational ancillary facilities would generally follow conventional building design and construction practices common in Sydney for the type of building, with a combination of prefabrication and onsite works. Following construction of the facilities, plant and equipment would be tested prior to commissioning.

Ventilation facilities

Two tunnel ventilation facilities would be constructed as part of the project. The western ventilation facility would be located adjacent to Underwood Road near the western on- and off-ramps to the mainline tunnels. The eastern ventilation facility (which includes ventilation outlets for both the project and the possible future M4-M5 Link project (which is subject to separate planning approval) (M4–M5 Link)) would be located adjacent to Parramatta Road between Wattle Street and Walker Avenue.

The construction methodology for the western ventilation facility would be integrated and sequenced with the westbound cut-and-cover tunnel structure and would typically involve the following activities:

- Completion of the excavation and construction of the westbound cut and cover roof structure at Underwood Road
- Construction of the ventilation facility floor, walls and roof, including suspended slabs and steel frames for the fans, dampers and louvres
- Construction of the surface exhaust and supply ventilation building
- Erection of the façade as per architectural design

- Internal fitout of plant areas, equipment installation and commissioning
- Landscaping.

The construction methodology for the eastern ventilation facility would be a standalone operation typically involving the following activities:

- Excavate and civil fitout the ventilation connection shaft
- Installation and construction of ventilation facility foundation, floor, walls and roof, including suspended slabs and steel frames for the fans, dampers and louvres
- Installation of block walls and steel roof to enclose the ancillary building
- Erection of the façade as per architectural design
- Construction of the surface ventilation facility
- Internal fitout of plant areas, equipment installation and commissioning of the ventilation outlet for the project. Fitout, equipment installation and commissioning of the ventilation outlet for the M4–M5 Link would occur as part of construction of the M4–M5 Link (if approved)
- Landscaping.

In addition to the ventilation facilities, a fresh air supply facility would be provided at Cintra Park at Concord. The need for this facility would be determined during detailed design. The construction methodology for the fresh air supply facility would typically involve the following activities:

- Excavation of temporary decline and ventilation drive to the mainline tunnels. This drive would also be used for temporary construction access, with the fresh air supply constructed once this access is no longer required
- Construction and installation of footings, base floor slab and walls
- Installation of walls and roof over the substation structure
- Backfilling temporary tunnel decline around the structure
- Internal fitout of plant areas, equipment installation and commissioning
- Landscaping.

Motorway operations complex

The motorway operations complex, comprising the motorway control centre and maintenance facility building, would be located on the northern side of the existing M4, east of the Homebush Bay Drive interchange.

The site would initially be used as a spoil handling facility. Once the existing M4 traffic is relocated across the top of the cut-and-cover structure, the spoil handling facility would no longer be required and the operations complex would be constructed on this site.

Construction of the motorway operations complex would typically include:

- Site preparation, bulk excavation and construction of retaining walls as required
- Detailed excavation, footing and base slab installation
- Erection of blockwork walls, steel posts and steel roof
- Enclosure of the buildings including architectural treatments
- Internal fitout of local control rooms, computer rooms, offices, workshop and associated staff amenities
- Construction of an open storage and hardstand area for vehicles, plant and miscellaneous items
- Erection of security fencing and landscaping.